

MEETING HIGHLIGHTS
Hanford Site Technology Coordination Group
Management Council

January 21, 1998
EESB Snoqualmie Room
8:30 a.m. to 12:15 p.m.

PURPOSE

- To understand and discuss revised Deployment Center plans
- To present FY 1997 Demonstration and Deployment Accomplishments

AGENDA

Introduction/Safety/Continuous Performance Improvement

STREAM (Shannon Saget/Steve Pulsford)

- STREAM (System for Tracking Remediation, Exposure, Activities, and Materials) is a multi-media database which electronically provides day-to-day acknowledgment of work performance and management tracking. This technology is currently being used at C-Reactor, and can be customized to focus on the information needs of any project.

Linkage to Needs / EMSP Call for HLW Proposals (Loni Peurrung)

- A crosswalk between our Hanford's science needs and the EMSP projects has been initiated (attached). Follow-up work will include defining approaches for connecting science with the users. Loni Peurrung asked for volunteers to help with this activity.

Deployment Center Annual Report (FDH/BHI/PNNL)

- The goals and organizational structure of the Deployment Center were presented, and representatives from each of Hanford's contractors discussed their accomplishments.

FY 1997 Demonstration/Deployment Accomplishments (FDH/BHI/PNNL)

- Presentations were given by contractor representatives on the demonstration and deployment accomplishments in FY 1997.

RL Commitment to Deployment (Dave Biancosino)

- RL has committed to 11 technology deployments at Hanford in FY 1998. A Deployment Plan is due May 1.

Future Agenda Items

- CETI Update
- ITRD Groundwater Work
- DC Arc Technology Update (March)
- Hanford Site Deployment Plan (March)
- EMSL Tour
- In Situ Redox Technology Update

ACTION ITEMS

None

WRAP-UP

The next meeting will be on February 18, from 8:30 a.m. to 12:30 p.m. in the ETB Columbia River Room. **Please note the change of location for this meeting.**

HANFORD SITE TECHNOLOGY COORDINATION GROUP MANAGEMENT COUNCIL MEETING MINUTES

January 21, 1998
EESB Snoqualmie Room
8:30 a.m. - 12:15 p.m.

INTRODUCTION/SAFETY/CONTINUOUS PERFORMANCE IMPROVEMENT

Lloyd Piper opened the meeting. Introductions were made around the room.

Safety: Tom Frater reminded everyone to be careful when unpacking boxes during a move. It's easy to cut yourself if you try to open the seam with your fingers.

CPI: Wayne Green commented on the difference between "hopefully" and "hopeful." "Hopefully" implies that someone else will take action; "hopeful" means you'll take action yourself.

Announcements

Under Secretary of Energy Ernest Moniz is visiting Hanford today and tomorrow, with a focus on vadose zone groundwater issues.

John Wagoner is going to HQ next week for a Technology Acceleration Committee meeting with the Site Managers and the Deputy Assistant Secretaries. They will be discussing acceleration of technology deployment.

Next week is Al Alm's last week. It has not been announced yet who will replace him.

The STCG Handbook has been updated, and revisions were passed out. The STCG Annual Report has been finalized and is included in the update to the STCG Handbook.

Lloyd showed a Baseline Technology Insertion Timeline indicating the technology insertion point as the point at which the bid is ready to go out for commercial technology. He has directed FDH and BHI to include technology insertion points in their baselines so we can tie them to our technology needs statements. Technology insertion points will provide an indication of whether there is time to develop a technology. It is necessary to document the technology insertion with a baseline change request showing schedule, cost, or risk reduction. That provides concrete proof that we have made a positive improvement to our baseline with the new technology. If you do a little incremental S&T investment before the insertion point, you might be able to save time and money with a new technology. That's your return on investment.

Bob Rosselli noted that the key to science and technology (S&T) progress is to build technologies into the baseline to reduce cost, schedule, or risk. C-Reactor is a good

example of this, as is the Canyon Disposition Initiative (CDI). Dirk Dunning cautioned DOE to analyze the downside of the CDI as well as the upside.

John Neath reported that the Strategic Laboratory Council asked the Environmental Management Advisory Board (EMAB) to review the OST Program to be sure that it is aligned with the EM-30/40/60 programs' needs. The EMAB will be at Hanford next week.

The GAO will visit Hanford for three days next week. They are interested in following up on past technology developments and deployment.

Greg Berlin summarized the tour scheduled for this afternoon to the 222-S Analytical Laboratory.

Dave Biancosino explained the purpose and agenda for the meeting.

STREAM

Shannon Saget introduced a C-Reactor technology which was developed by Delphinus Engineering. Since their offices are located across the country from the Hanford Site, they took videos of the C-Reactor facility, loaded them into computers, and created a multi-media database. It is an extremely useful tool.

Steve Pulsford (BHI) provided more details. "STREAM" stands for "System for Tracking Remediation, Exposure, Activities, and Materials." It is a multi-media FoxPro database (for Windows) which electronically provides day-to-day acknowledgment of work performance and management tracking. It can be customized to focus on the information needs of a specific project. You can see exactly what to do and know the conditions before you actually go into the building.

It streamlines management and tracking of waste from generation to disposal (e.g., what's recycled, decontaminated, sent to ERDF, sent offsite). The data entry forms are consistent with the format used at Hanford. Operations, project management, and waste management reports can be prepared with the database.

STREAM's uses and benefits include:

- Field Engineering and Operations (work package development, plan-of-the-day meetings, pre-job reviews, briefings, and training),
- Technology Demonstration (requirements analysis work package, readiness reviews, and pre-demo reviews)
- Health and Safety and Radiological Controls (ALARA and safety),
- Project Management (presentations, project reviews, visitor briefings)

Costs: \$125K for the ERC Site licensing agreement
 1 FTE for the first 3 months, 0.25 FTE to maintain
 \$400 for present computer upgrade
 \$4,000 for digital cameras, docking station, scanner, CD writer, color printer.

They are doing important up-front planning for F-Reactor now.

Rick Gonzales asked how much money they have saved. Steve Pulsford replied that they have saved \$30K per man-rem and that they project savings of \$2.1 million if they do all the reactors. There has been a 4% savings to the project for C-Reactor (\$20 million total project cost). Rick asked if they have a baseline that will show what the savings are. Steve indicated that they haven't done a baseline change control yet. They are not doing the old baseline any more, and they will be working on documenting the savings.

Dave Langstaff suggested that it would be good if they could expand the license to include B&W.

EMSP LINKAGE TO NEEDS / EMSP CALL FOR HLW PROPOSALS

Loni Peurrung gave an update on the Environmental Management Science Program (EMSP). They have started to do a crosswalk between our science needs and the EMSP projects. EMSP has 202 projects; 22 are either at PNNL or involve PNNL staff.

A table showing each project, the principal investigator (PI), the award date, and the Hanford science or technology need it addresses is attached. Some of the EMSP projects may not meet any Hanford needs. The table is out for review now. The good news is that there are pretty good linkages. Most EMSP projects appear to be relevant to our Site needs. The bad news is that the EMSP draft linkage report to Congress does not link projects to specific needs. Further work would be needed to link all projects to Hanford needs.

Follow-up work will include completing the table for all EMSP projects, establishing communications between EMSP PIs and points of contact for the science needs, and defining other approaches for connecting the science with the users. Loni would like to develop a list of people who want to get this going.

Mike Jacobsen asked how many needs relate to tanks and how many might lead to tank privatization. The answer was about 12-13.

Norm Olson commented that FDH is trying to work with PNNL in this area. We're trying to link the EMSP PIs with the contractor champions for the S&T needs.

Loni reported that 10 EMSP D&D preproposals were submitted by PNNL, and PNNL staff have been asked to prepare eight actual proposals. 30 preproposals will be submitted next week for the EMSP HLW call.

DEPLOYMENT CENTER ANNUAL REPORT

Tom Anderson restated the goals and organizational structure of the Hanford Technology Deployment Center that were presented at the December STCG Management Council meeting. The scope of work for FDH is to:

- identify technology needs
- seek alternative technologies to meet those needs
- create a market pull infrastructure
- support and integrate efforts with the DOE-established technology management process.

Tom identified accomplishments and opportunities for improvement for the following seven performance agreements:

1. Integrate Site needs into the National Technology Development Program

Accomplishments:

- technology needs documents issued
- participation in TFA's Technical Advisory Group
- 12 TDI proposals submitted
- meetings with NIST, Fernald, LANL, SRL, and Florida International University
- participation in FETC and other Focus Area meetings
- proposal award to address the need for microencapsulation of mixed waste debris
- TDI award for the Transport Slurry Monitoring proposal

Opportunities for Improvement:

- expand outreach to align Hanford technology needs with industry research
- expand efforts to map DOE's ongoing technology development efforts with Hanford's needs
- expand interactions with other DOE sites to maximize Hanford's benefits from similar problems solved by others

2. Participate in the Site Technology Coordination Group

Accomplishments:

- two representatives serve on the Management Council
- one or more serve on each of the four STCG Subgroups
- one or more MSC representatives participate in each of the Subgroups
- coordinated the process of technology needs identification by projects across the Site
- member of the STCG facilitation team
- submitted technology demonstration and deployment fact sheets to the Subgroups for review and comment
- participated in ad hoc committees to revise the STCG mission and roles and responsibilities

Opportunities for Improvement:

- shift the focus of technology needs identification towards more of a long-term view
- increase the awareness of STCG members of technology demonstrations and deployments

3. Identify and prioritize technology needs

Accomplishments:

- coordinated with BHI in identifying Site technology needs and with PNNL in identifying science needs
- issued Technology Needs Statements for 1997 and 1998
- two TDI proposals were submitted to the Hanford Waste Minimization Program and were successfully funded

Opportunities for Improvement:

- clarify technology need opportunities to improve the focus of industry's response
- establish the needs survey process as a higher-priority requirement

4. Survey industry, other DOE sites, and other agencies for applicable technologies

Accomplishments:

- technology needs advertised on the Internet
- technology needs sent to DOE-sponsored Focus Areas
- other institutions notified of the Hanford technology needs
- contact database to assist industry with making their technology information available to the Hanford contractors
- acquisitions/contractor "getting acquainted" workshop
- "How to Do Business at Hanford" to the Northwest Environmental Business Council
- MOU with Pacific Rim Enterprise Center to assist with surveying available technologies
- TRICIPE trade show

Opportunities for Improvement:

- seek technologies at other federal labs; be more aggressive; budget restraints have led to disappointing results
- exploit technologies available with Numatec

5. Evaluate technologies to meet Site needs

Accomplishments:

- use of systems engineering in TWRS project planning to identify technology options
- Spent Nuclear Fuel Project evaluated numerous approaches to identify a treatment and disposal path for the sludge from the K Basins
- projects have conducted many specific independent peer reviews of technical approaches and the technology selections

- documentation of over ten technology demonstrations
- over fifteen technologies deployed

Opportunities for Improvement:

- fully utilize risk-based analysis to support technology investments
- develop a tool to complete rapid screening of candidate technologies

6. Seek ways to use new technologies to perform the work better, faster, and cheaper

Accomplishments:

- 37 technologies under consideration for demonstration
- baseline savings over ten years of \$1.2B if they could be successfully deployed
- 17 successful deployments with near-term cost savings of \$76M
- more than 50 vendors involved

Opportunities for Improvement:

- align other funding opportunities to Hanford needs
- link cost savings to the baseline

7. Identify opportunities for technology demonstrations and deployments

Accomplishments:

- program logic developed to organize projects and plans systematically (TWRS)
- risk management lists developed (TWRS)
- interviews to identify problem areas, particularly in operations
- initiated alignment/partnership meetings with DOE-RL STP
- established Technology Steering Groups for all projects
- distributed Technology Needs Statements
- established vendor contact database
- participated in National Focus Area technical reviews

Opportunities for Improvement:

- systems approach to planning in all projects
- a longer-term investment strategy

Nancy Uziemblo asked if the cost savings estimates were documented. Tom responded by saying that broad summary data are available. Bob Rosselli clarified that the information is available, but it's not in an orderly process that has gone through change control where we can see the benefit immediately. That's what we're working on. Terry Walton added that there are additional benefits besides cost savings that are much more difficult to document.

John Murphy asked how many technology deployments have come through the Deployment Center. The answer was that all of them have.

Wayne Martin asked if the Deployment Center was managed by FDH or DOE. Bob Rosselli said that it is managed by FDH. Tom Anderson said that DOE crafted it while the PHMC was being bid. DOE is the umbrella for the Deployment Center, but

FDH, BHI, and PNNL do the work. Bob Rosselli's shop is responsible, and Dave Biancosino is the point of contact.

Dennis Faulk commented that to get a true cost savings to the Site, you need to add in the initial investment of funding for FDH, BHI, and PNNL.

Jerry White presented the Bechtel Hanford, Inc. HTDC accomplishments:

- demonstrated 15 technologies
- deployed 7 technologies
- two technologies considered for FY98 deployment
- response to TDI process
- lessons learned from TDI process
- support SLC Action Team on turning technology deployment into a clear success
- developed problem statements for key BHI groundwater technology problems for interactions with industry
- technology information exchange with INEEL
- conducted several Site workshops

Lloyd Piper said that BHI has been tasked to be the lead on vadose zone and groundwater issues on Site.

Dennis Faulk commented that he was glad to see the words "Canyon Disposition Initiative" rather than "Canyon Disposal Initiative". It is important to reach a decision on the canyon facilities, no matter what the decision is.

Tom Page presented the activities performed by PNNL. PNNL is a technology provider to DOE, and includes Hanford as a major client. The Laboratory has a critical outcome to develop, demonstrate, and deploy new and innovative technologies, although the deployments are done through others. The performance agreements in PNNL's contract and accomplishments are:

Number of new and/or innovative technologies successfully demonstrated

- 14 technologies successfully demonstrated
- focused on tank waste retrieval and separations
- performance kept pace with last year despite funding reductions

Provide significant solutions to Hanford problems/needs

- 16 Hanford activities were completed in FY97
- a number of technology, engineering, and technical services were provided in support of the Hanford mission, including evaluations of numerous private-sector technologies for BHI

Number of formal expressions of interest entered into

- 11 formal expressions of interest were entered into in FY97
- strong performance indicates future deployment opportunities

Number of new and/or innovative technologies successfully deployed in commercial practice

- 21 technologies were deployed in FY97
- increased focus and key investments are driving strong performance

Nancy Uziemblo asked if the demonstrated technologies are at an appropriate gate to allow us to insert them into the baseline. Tom said that some of them are, but some decisions will have to be made by the privatization contractor.

Dennis Faulk asked about the criteria for judging a demonstration, since the computer tool for bioremediation didn't make the list. It didn't work, but it should still be counted. Tom said that we judge a demonstration successful when the client can make a decision to use it or not.

Mike Jacobsen commented that the Pacific Rim Enterprise Center has done three things in support of the Deployment Center:

- responsible for organizing an industry outreach -- spoke with over 100 companies about Hanford needs
- submitted to FDH and BHI approximately 30 technology proposals specific to Hanford needs
- prepared nine barrier papers (six were specifically for Hanford)

FY 1997 DEMONSTRATION/DEPLOYMENT ACCOMPLISHMENTS

Tom Page included PNNL's demonstration and deployment accomplishments with the previous presentation.

Summary:

- 14 technologies successfully demonstrated
- 16 Hanford activities were completed in FY97
- 11 formal expressions of interest were entered into in FY97
- 21 technologies were deployed in FY97

Jerry White presented the FY97 accomplishments for BHI. They focused on the environmental restoration part of the Site. The accomplishments are divided up into five project areas on Site.

Accomplishments:

- evaluated over 90 technologies against environmental restoration technology needs (300-400 in the last 3 years)
- demonstrations/deployments (C-Reactor project and soils and groundwater projects)
- \$7M in leveraged funding (mainly from EM-50). This is the enabling function to go forward, take risks, and do demonstrations. The projects do not have the necessary funds.
- 11 technologies demonstrated at C-Reactor
- 7 technologies deployed at C-Reactor

- 4 technology demonstrations in soils and groundwater
- technology proposals
 - 2 TDI proposals -- U-Plant Characterization and In Situ Redox Manipulation
 - 5 technology proposals to other programs
- Needs and communication
 - developed detailed needs statements
 - developed detailed problem statements
 - held five workshops and technical exchanges
 - screened and characterized technology needs for U-Plant
 - initiated work on the Canyon Disposition Initiative

Summary:

- Increased demonstration and deployment activity over FY96
- Significantly added to technology database
- Communicated needs and fostered technical exchange activities
- Planning for technology deployment in support of U-Plant and groundwater projects

Jerry noted that Hanford has ongoing decision processes for reactors, tanks, and waste sites, but not for the canyons. Project managers are risk-averse; they need access to detailed information and technology track records before they can be convinced to use a new technology.

Wayne Martin commented that \$7M in leveraged funds is not a lot. Our project people do not have funding to play with technologies. Jerry agreed and said that their baselines have been set up to complete the project with existing technology. We need to come up with cost-sharing options to reduce the risk of using new technologies. Projects are not able to come up with money to demonstrate a new technology.

Dirk Dunning commented that there are huge engineering challenges to using the canyons as disposal facilities. They need buy-in from stakeholders from the beginning. Jerry said that they want to involve the regulators and stakeholders early in the process. They will be putting together a technology group to bring in people from both inside and outside DOE to look at technology gaps. He invited those interested to be part of that forum. The engineering challenges will be part of the technology assessment process.

Rick Gonzales said that they have been briefing the contractors and DOE so they know what's going on.

Pam Brown asked if the facilities will be buried. Jerry said that in any situation, a barrier will be used. The major issue is if the barrier will work.

Tom Anderson introduced several speakers to present FDH accomplishments.

Larbi Bounini -- Waste Management

Many of the deployments are in the WRAP facility, mainly to screen for TRU, identify specific isotopes in the waste, and reduce waste volume prior to burial. They could

reduce the overall waste volume by a factor of 4 to 1. Macroencapsulation will lead to a 65% volume reduction.

FY97 Mixed Waste Deployments:

- deployed 8 technologies in 3 areas (details were given on 3 of these technologies)

Jim Honeyman -- TWRS

FY97 Tanks Activities and Deployments:

- deployed 10 technologies in 5 areas (excluding waste retrieval)
- received formal acceptance of enhanced sludge washing as TWRS baseline

There could be a \$10 billion reduction in future repository fees due to the use of enhanced sludge washing to reduce the high-level waste volume.

Dave Jackson -- Spent Nuclear Fuel (SNF)

Development Testing:

- fuel handling -- Conan Manipulator (6-foot reach, lifts 375 pounds, works under water)
- fuel basket loading
- fuel washing

Validation Testing:

- first manipulator will be validated soon

Where we go from here:

- FRS non-rad tests complete this spring
- currently preparing for equipment installation in K-West basin this spring

Pam Brown commented that the SNF report was critical of procurement. She asked if they are having procurement problems. Dave Jackson said that they have worked past the procurement problems.

Bill Root -- Hanford Tanks Initiative (HTI)

Alternate retrieval technology demonstrations completed in FY97:

- 2 arm-based systems
- 2 vehicle-based systems

C-106 deployment contracting strategy:

- 8 proposals received, with 2 awarded for system definition/design/testing
- in a year, will down-select to one vendor for final fabrication/assembly/qualification

Planned demonstrations/deployments:

- Cone Penetrometer for vadose zone sampling
- Slurry Monitoring for pipeline transport
- LDUA

- extended-reach end-effector (EREE)
- Magnetometer Waste Depth Sensor

Budget:

- \$43M retrieval
- \$9M tank characterization
- \$3M vadose zone characterization
- \$6M retrieval performance

Rico Cruz asked how much of the funding is coming from EM-50. Bill responded that in FY97 and FY98, EM-50 funding is approximately 60% of the total.

RL COMMITMENT TO DEPLOYMENT

Dave Biancosino provided information about a letter signed by RL committing to 11 technology deployments at Hanford in FY98. RL is required to submit a Deployment Plan by May 1. The STCG will be involved in the development and approval of the Deployment Plan.

FUTURE AGENDA ITEMS

- CETI Update
- ITRD Groundwater Work
- DC Arc Technology Update (March)
- Hanford Site Deployment Plan (March)
- EMSL Tour
- In Situ Redox Technology Update

COMMUNICATIONS ACTIONS

Susan Ennor said that she is working on an article and will be contacting people for their input on what we will be doing that warrants coverage.

WRAP-UP

The next meeting will be on February 18, from 8:30 a.m. to 12:30 p.m. in the ETB Columbia River Room. **Please note the change of location for this meeting.**

TOUR -- 222-S ANALYTICAL LABORATORY

STCG Management Council members and other interested parties were invited to tour the 222-S Analytical Laboratory. The tour took place after the regular meeting, from 12:30 p.m. to 4:30 p.m.

PNNL EM Science Program Projects Linked to Hanford Science and Technology Needs

Draft 12/19/97 LM Peurrung and SA Rawson

Project descriptions available at web site <http://www.doe.gov/em52/institution.html> under Pacific Northwest National Laboratory

Project Title	PNNL Principal Investigator	Award Date	Hanford Science or Technology Need Addressed
Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing	AR Felmy	1996	RL-WT041-S, Radionuclide Partitioning
Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing	BC Bunker	1996	RL-WT049-S, Effect of Processing on Waste Rheological and Sedimentation Properties
Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides	SA Chambers	1996	RL-SS24-S, Chemical Binding on Site-Specific Mineral Surfaces
Interfacial Radiolysis Effects in Tank Waste Speciation	TM Orlando	1996	RL-WT042-S, Flammable Gas Generation, Retention, and Release in HLW Tanks
Radiation Effects in Nuclear Waste Materials	WJ Weber	1996	RL-WT034-S, Long-Term Performance of LAW Forms
Architectural Design Criteria for F-Block Metal Ion Sequestering Agents	BP Hay	1996	RL-WT048-S, Innovative Methods for Radionuclide Separation
Dynamics of Coupled Contaminant and Microbial Transport in Heterogeneous Porous Media	TR Ginn	1996	RL-SS27-S, Rates of Coupled Abiotic and Biogeochemical Reactions Involving Contaminants in Hanford Subsurface
Mechanism Involved in Trichloroethylene-Induced Liver Cancer: Importance to Environmental Cleanup	RJ Bull	1996	(none)

Project Title	PNNL Principal Investigator	Award Date	Hanford Science or Technology Need Addressed
Ionizing Radiation Induced Catalysis on Metal Oxide Particles	TA Fryberger	1996	RL-MW05, Remote Treatment of RH Soils and Other Solid Wastes Contaminated with Organics
Genetic Analysis of Stress Responses in Soil Bacteria for Enhanced Bioremediation of Mixed Contaminants	KK Wong	1996	RL-SS32-S, Reactivity of Organics in the Hanford Subsurface
Subsurface High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions	FJ Brockman	1996	RL-SS29-S, Effect of Subsurface Heterogeneities on Chemical Reaction and Transport
Determination of Transmutation Effects in Crystalline Waste Forms	NJ Hess	1996	RL-WT036-S, Alternate Waste Form Development
Aqueous Electrochemical Mechanisms in Actinide Residue Processing	DL Blanchard	1997	(none)
Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste	DL Blanchard	1997	RL-WT048-S, Innovative Methods for Radionuclide Separation; RL-WT041-S, Radionuclide Partitioning; RL-WT01, Technetium-99 Analysis in Low Level Waste Feed
Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions	JL Fulton	1997	(possibly RL-WT06, Identification and Management of Problem Constituents for HLW Vitrification)
New Silicotitanate Waste Forms: Development and Characterization	ML Balmer	1997	RL-WT036-S, Alternate Waste Form Development
Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of ¹³⁷ Cs from HLW Tank Discharges	JM Zachara	1997	RL-WT053-S, Contaminant Mobility Beneath Tank Farms; RL-SS30-S, Cesium Migration Beneath Waste Tanks

Project Title	PNNL Principal Investigator	Award Date	Hanford Science or Technology Need Addressed
Ion-Exchange Processes and Mechanisms in Glasses	BP McGrail	1997	RL-WT034-S, Long-Term Performance of LAW Forms
Distribution & Solubility of Radionuclides & Neutron Absorbers in Waste Forms for Disposition of Plutonium Ash & Scraps, Excess Plutonium, and Miscellaneous Spent Nuclear Fuels	X Feng	1997	(none)
Radiolytic and Thermal Process Relevant to Dry Storage of Spent Nuclear Fuels	SC Marschman	1997	(none)
Phase Chemistry of Tank Sludge Residual Components	J Liu	1997	supports RL-WT013, Establish Retrieval Performance Evaluation Criteria
Mechanics of Bubbles in Sludges and Slurries	PA Gauglitz	1997	RL-WT042-S, Flammable Gas Generation, Retention, and Release in HLW Tanks